BONE DEFORMITY IDENTIFICATION USING MACHINE LEARNING

A Mini Project Report

submitted by

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to

the APJ Abdul Kalam Technological University
in partial fulfillment of the requirements for the award of the Degree

of

Master of Computer Applications

Department of Computer Applications

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DECLARATION

I undersigned hereby declare that the project report **BONE DEFORMITY IDENTIFICATION USING MACHINE LEARNING**, submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Applicationsof the APJ Abdul Kalam Technological University, Kerala, is a bonafide work done by me under supervision of Mr Nowshad CV , Assistant Professor, Department of Computer Applications. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Place:Kuttippuram

Date:28/02/2022

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DEPARTMENT OF COMPUTER APPLICATIONS
MES COLLEGE OF ENGINEERING, KUTTIPPURAM

CERTIFICATE

This is to certify that the report entitled **BONE DEFORMITY IDENTIFICATION USING MACHINE LEARNING** is a bonafide record of the Mini Project work carried out by **VISHNU K(MES20MCA-2059)** submitted to the APJ Abdul Kalam Technological University, in partial fulfillment of the requirements for the award of the Master of Computer Applications, under my guidance and supervision. This report in any form has not been submitted to any other University or Institution for any purpose.

Internal Supervisor(s) External Supervisor(s)

Head Of The Department

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Abstract

The fractures which are non-detectable and which are not diagnosed properly are the two major challenges to the orthopedicians and radiologists in the field of orthopaedics. In many countries the count of patients with bone-related fracture issues is increasing very rapidly, especially many are meeting with an accident. Additionally, due to a shortage in rural areas where the medical facility is very poor and unavailability of orthopaedics makes the introduction of Computer-based systems.

Keywords: Identification of Bone Deformation

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Chapter 1

Introduction

1.1 Background

As per the reports of World Health Organization (WHO), bone fractures are the third largest and a leading health care problem due to increase in the number of accidents these days.. Traumatic injuries contribute more in the case of deaths and permanent disability .X-ray images are the sources which are majorly accessible to the people during accidents. Though MRI and CT also contribute to the same purpose, X-rays are mostly preferred due to its low price. Majorly X-rays are taken under poor lighting conditions and also due to noise it is very difficult to detect the thin line fractures with a visual interpretation of X-rays by orthopedicians. With the advancement of the ComputerAided Diagnosis, the imaging technology helps the radiologists for the speedy location of fractures and alsohelps in fastening the decisions taken for Surgery.

1.1.1 Motivation

Bone fracture is quite a familiar problem in humans which is caused by falls, accidents, disease as pathological fractures, injury to the overlying skin, hairline fracture, etc. Doctors can diagnose bone fractures with x-rays. They may also use CT scans (computed tomography) and MRI scans (magnetic resonance imaging).Nevertheless, sometimes the size of fractures is not significant and could not be detected easily,it Requires more manpower .The system is not efficient and it have more Time consuming and aslo a common man cant detect the fracture.This project reduces the job stress of doctors and orthopedics.It is very easy for the all age groups of men and women.It gives a summarized result of detection of bone,so it is very easy to identification of fracture.

1.2 Objective

To identify bone fracture using machine learning algorithms, by which workload for orthopedics can be reduced. It is applicable to all age groups of men, women and children. It provides a summarized and evaluated results of any detected deformity or fracture based on the x-ray images.

1.3 Report Organization

The project report is divided into four sections. Section 2 describes literature survey. Section 3 describes the methodology used for implementing the project. Section 4 gives the results and discussions. Finally Section 5 gives the conclusion.

Chapter 2

Literature Survey

An important problem in clinical orthopedics is determining the power of a healing fracture. computer-based bone fracture is more effective s it reduces the most of the work done by the orthopedics.Bone sizes are not the same for all kinds of humans and bones with fractures contain some cracks on it.Size of the bone changes with external stress. An algorithm for segmentation of long bones from digital x-rays is introduced in data is collected after inspecting various bone shapes. To identify the bone in an image, after performing edge detection, an edge which belongs to the boundary should be in the calculated ranges. Scale and rotation invariant algorithm are used. Partial or complete bones can be identified. In brief introduction of computer-aided diagnosis (CAD) is explained briefly. It has become one of the important research in medical imaging and radiology. Various Cad schemes are explained. CT scan is made effective in the cases of finding the region of interests and also the segmentation further feature extraction but X-rays made more comfortable in case of fracture detection with cost-effectiveness and access to all kinds of the people total automated techniques are proposed with the use of image invariant.

Chapter 3

Methodology

3.1 Introduction

A Convolutional Neural Network, also known as CNN or ConvNet, is a class of neural networks that specializes in processing data that has a grid-like topology, such as an image. A digital image is a binary representation of visual data. It contains a series of pixels arranged in a grid-like fashion that contains pixel values to denote how bright and what color each pixel should be.The human brain processes a huge amount of information the second we see an image. Each neuron works in its own receptive field and is connected to other neurons in a way that they cover the entire visual field. Just as each neuron responds to stimuli only in the restricted region of the visual field called the receptive field in the biological vision system, each neuron in a CNN processes data only in its receptive field as well. The layers are arranged in such a way so that they detect simpler patterns first (lines, curves, etc.) and more complex patterns (faces, objects, etc.) further along. By using a CNN, one can enable sight to computers.X-ray images are frequently affected by noise. This project was developed using Agile Development Model. The entire project was divided into four sprints. In the first sprint, the characters for the password was developed. The designing of front-end and development of back-end was done in the second , third and fourth sprint respectively.

Chapter 4

Results and Discussions

4.1 Datasets

MURA: A large dataset of 40,561 bone X-ray images consisting of elbow, finger, hand, humerus, forearm, shoulder, and wrist is publicly available for research use. The dataset is labeled by six board-certified expert radiologists from Stanford hospital and classified it into normal and abnormal cases.Medpix is an online datatbase of medical images.Radiopaedia contains more than 2800 fracture cases are freely available with diagnosis information.IIEST, Shibpur Indian Institute of Engineering Science and Technology contains 49 healthy, 99 fractured and 69 cancerous bone X-ray images are publicly available for sole purpose of conducting research.MOST: Multicenter Osteoarthritis Study (MOST)contains Dataset of knee joint X-ray and MRI images is available with diagnosis report collected from case report forms (questionnaires and examinations).

4.2 Result

After the training of data set the features of each x ray image (ie fractured bone and unfractured)extracted and compare with user inputs and aslo compare with trained data set and shows whether there is fracture or not.This is very accurate.Obtained Accuracy, Specificity, Sensitivity by applying SIFT and Back Propagation Neural Network are 90,88,87 respectively. These results are compared with HTBFB(Hough Transform Based Fracture Detection) which got Accuracy of 83, Specificity of 86 and sensitivity of 84. And also the results are compared with Statistical features extraction along with Artificial neural network classifier which got results with an accuracy of 84, Specificity of 85 and Sensitivity of 86.

Chapter 5

Conclusions

Proposed Computer-Aided Fracture Detection technique is presented based on the Bag-Of-Visual-Words(BOVW) and for feature extraction SIFT is used. With the results, it can be estimated that the proposed methodology works better. The work experiments over 300 X-rays images which are collected as a dataset from KIMS hospital, Hyderabad. Out of 300 X-rays 200 X-rays taken for training and 100 for testing. The experimental results give 90compared to HTBFD(Hought transform Based Fracture Detection) and CNN(Convolution Neural Network) Which can be used for better location of the fracture.

References

[1] **DG. Lowe** Object recognit ion from local scale-invariant features. In Computer Vision, 1999. The Proceedings of the Seventh IEEE Internat ional Conference, volume 2, pages 1150 – 1157, Sep 1999 .

[2] **D. Ryder, S. King, C. Olliff, and E. Davies** A possible method of monitoring bone fracture and bone characterist ics using a noninvasive acoust ic technique, Internat ional Conference on Acoust ic Sensing and Imaging (1993), pp. 159–163.

[3] **J. Kaufman, A. Chiabrera, M. Hatem, N. Hakim, M. Figueiredo, P. Nasser,S. Lat tuga, A. Pilla, and R. Siffert** A neural network approach for bone fracture healing assessment . IEEE Engineering in Medicine and Biology 9, 23(1990).

[4] **V. Singh and S. Chauhan** Early detect ion of fracture healing of a long bone for bet ter mass health care, Annual Internat ional Conference of the IEEE Engineering in Medicine and Biology Society (1998),pp. 2911–2912.

Appendix

Source Code

```
  import os.path

from flask import *
from werkzeug.utils import secure_filename
import cv2
from src.chhhhh import mainfn
from src.dbconnector import *

app=Flask(__name__)
app.secret_key="123"

import functools
def login_required(func):
   @functools.wraps(func)
   def secure_function():
      if "lid" not in session:
         return render_template('login.html')
      return func()

   return secure_function


@app.route('/')
def log():
   return render_template('login.html')

@app.route('/login',methods=['post'])
def login():
   uname=request.form['textfield']
   pword=request.form['textfield2']
   qry="SELECT * FROM `login` WHERE `username`=%s AND `password`=%s"
   val=(uname,pword)
   res=selectone(qry,val)
   if res is None:
      return '''<script>alert('invalid enrty');window.location="/"</script>'''
   else:
      if res[3]=='admin':
         session['lid']=res[0]
         return '''<script>alert('welcome');window.location="/adminhome"</script>'''
      elif res[3] == 'user':
         session['lid']=res[0]
         return '''<script>alert('welcome');window.location="/userhome"</script>'''
      else:
```

```
        return '''<script>alert('invalid entry');window.location="/"</script>'''



@app.route('/viewuser')
@login_required
def viewuser():
    qry="select * from `user_registration`"
    res=select(qry)
    return render_template('viewuser.html',val=res)


@app.route('/adddataset')
@login_required

def adddataset():
    return render_template('adddataset.html')


@app.route('/adminhome')
@login_required

def adminhome():
    return render_template('adminhome.html')

@app.route('/userhome')
@login_required
def userhome():
    return render_template('userhome.html')

@app.route('/viewfeedback')
@login_required
def viewfeedback():
    qry="SELECT `user_registration`.`firstname`,`lastname`,`feedback`.* FROM `feedback` JOIN `user_registration` ON
          `user_registration`.`lid`=`feedback`.`lid`"
    res=select(qry)
    return render_template('viewfeedback.html',val=res)


@app.route('/uploadimage')
@login_required
def uploadimage():
    return render_template('uploadimage.html')

@app.route('/uploadingimage',methods=['post'])
@login_required
def uploadingimage():
    image=request.files['file']
    file=secure_filename(image.filename)
    image.save(os.path.join("static/images/Fractured Bone",file))
    qry="INSERT INTO `image` VALUES(NULL,%s,%s,CURDATE())"
    val=(session['lid'],file)
    imgid=iud(qry,val)
    img = cv2.imread(
        "static/images/Fractured Bone/" + file)
    img = cv2.resize(img, (155, 284))
    cv2.imwrite("static/images/resized/" + file,
             img)

    try:
        print("================================")
        ff = mainfn(file)
        qry="INSERT INTO prediction_result VALUES(NULL, %s, %s, CURDATE(), %s)"
```

```
        val=(session['lid'],imgid,ff)
        iud(qry,val)
        return render_template("view.html", i=ff)
    except Exception as e:
        print(e)
        ff = mainfn(file)
        qry = "INSERT INTO prediction_result VALUES(NULL, %s, %s, CURDATE(), %s)"
        val = (session['lid'], imgid, ff)
        iud(qry, val)

        return render_template("view.html", i=ff)



@app.route('/addfeedback')
@login_required
def addfeedback():
    return render_template('addfeedback.html')


@app.route('/addingfeedback',methods=['post'])
@login_required
def addingfeedback():
    feedback=request.form['text']
    qry="INSERT INTO `feedback` VALUES(NULL,%s,%s,CURDATE())"
    val=(session['lid'],feedback)
    iud(qry,val)
    return redirect('userhome')



@app.route('/viewprediction')
@login_required
def viewprediction():
    qry="SELECT `prediction_result`.* ,`image`.`image` FROM `prediction_result` JOIN `user_registration` ON
         `user_registration`.`lid`=`prediction_result`.`userid` JOIN `image` ON `image`.`id`=`prediction_result`.`image`
         WHERE `user_registration`.`lid`=%s"
    res=selectall(qry,session['lid'])
    return render_template('viewprediction.html',val=res)

@app.route('/viewpredictionresult')
@login_required
def viewpredictionresult():
    qry="SELECT `prediction_result`.*,`user_registration`.`firstname`,`lastname`,`image`.`image` FROM `prediction_result`
         JOIN `user_registration` ON `user_registration`.`lid`=`prediction_result`.`userid` JOIN `image` ON
         `image`.`id`=`prediction_result`.`image` "
    res=select(qry)
    return render_template('viewpredictionresult.html',val=res)

@app.route('/signup')
def signup():
    return render_template('signup.html')


@app.route('/signingup',methods=['post'])
def signingup():
    fname=request.form['textfield']
    lname=request.form['textfield2']
    gender=request.form['radiobutton']
    place=request.form['textfield3']
    post=request.form['textfield4']
```

```
    pin=request.form['textfield5']
    phone=request.form['textfield6']
    username=request.form['textfield8']
    password=request.form['textfield9']
    query="INSERT INTO login VALUES(NULL,%s,%s,'user')"
    val=(username,password)
    id=iud(query,val)
    query="INSERT INTO user_registration VALUES(NULL,%s,%s,%s,%s,%s,%s,%s,%s)"
    val=(str(id),fname,lname,gender,place,post,pin,phone)
    iud(query,val)
    return '''<script> alert('Registration Success!');window.location='/userhome';</script>'''


@app.route('/logout')
def logout():
    session.clear()
    return redirect('/')









app.run(debug=True)
```

Database Design

Attribute Name	Datatype	Width	Description
id	Integer	11	Primary Key
username	Varchar	100	Unique
password	Varchar	100	NOT NULL
type	Varchar	100	NOT NULL

Table A.1: Login

Attribute Name	Datatype	Width	Description
id	Integer	11	Primary Key
lid	Integer	11	NOTNULL
firstname	Varchar	200	NOT NULL
lastname	Varchar	200	NOT NULL
gender	Varchar	200	NOT NULL
place	Varchar	200	NOT NULL
post	Varchar	200	NOT NULL
pin	Integer	11	NOT NULL
phone	Integer	11	NOT NULL

Table A.2: User registration

Attribute Name	Datatype	Width	Description
id	Integer	11	Primary Key
lid	Integer	11	NOTNULL
feedback	Varchar	200	NOT NULL
date	Date	10	NOT NULL

Table A.3: Feedback

Attribute Name	Datatype	Width	Description
id	Integer	11	Primary Key
userid	Integer	11	Unique
image	Varchar	200	NOT NULL
date	Date	10	NOT NULL

Table A.4: Image

Attribute Name	Datatype	Width	Description
id	Integer	11	Primary Key
userid	Integer	11	NOTNULL
image	Varchar	200	NOT NULL
Date	Date	10	NOT NULL
prediction	Varchar	200	NOT NULL

Table A.5: Prediction result

Dataflow Diagram

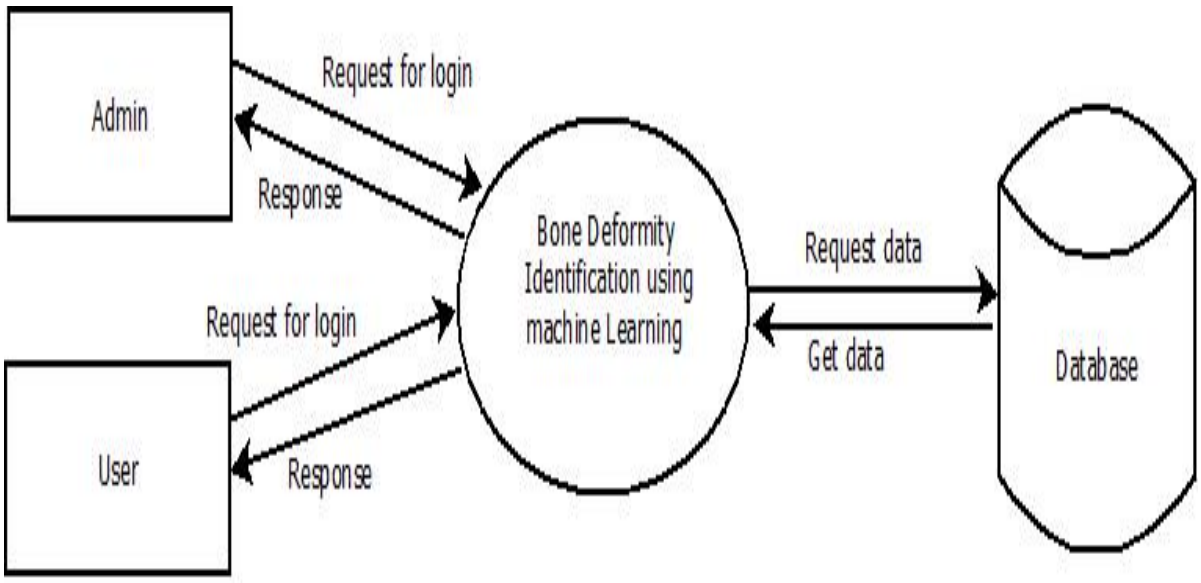

Figure A.1: Dataflow Diagram1

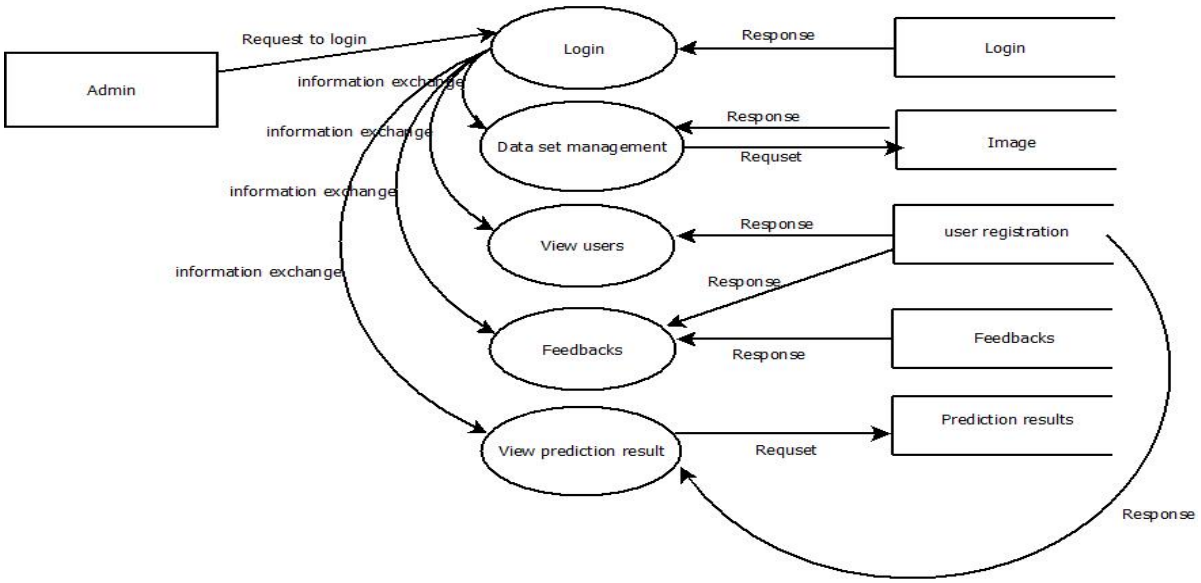

Figure A.2: Dataflow Diagram2

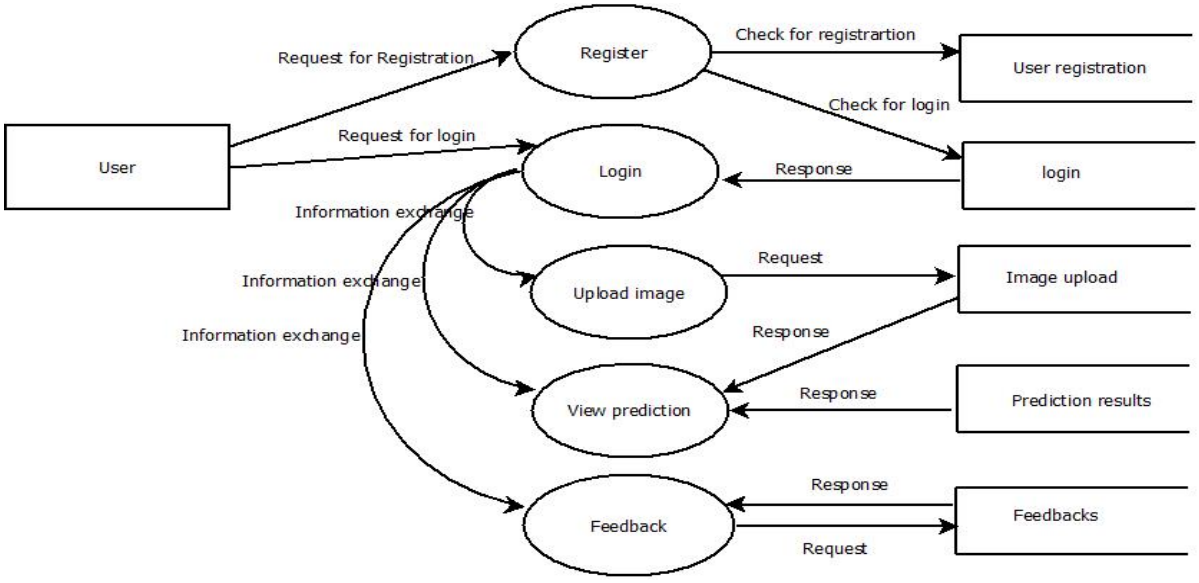

Figure A.3: Dataflow Diagram3

Screen shot

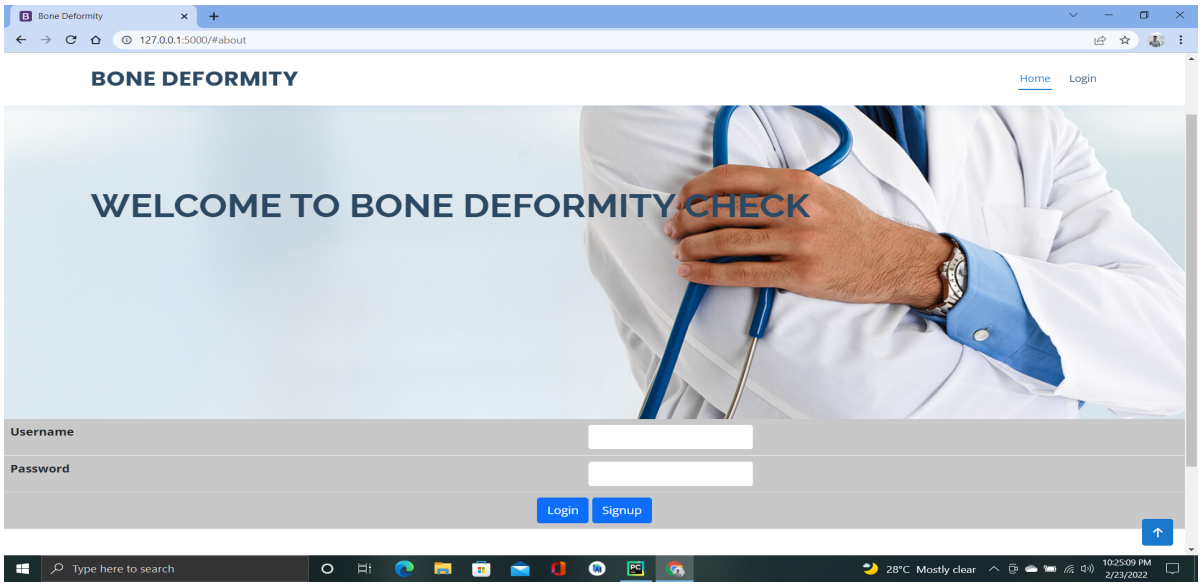

Figure A.4: User Interface 1

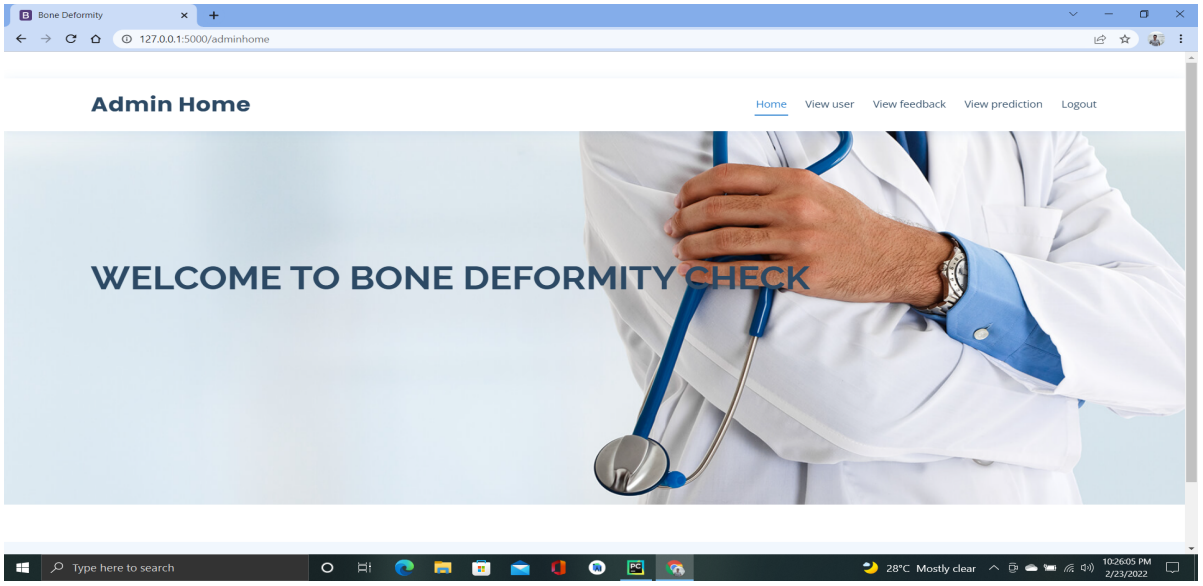

Figure A.5: User Interface 2

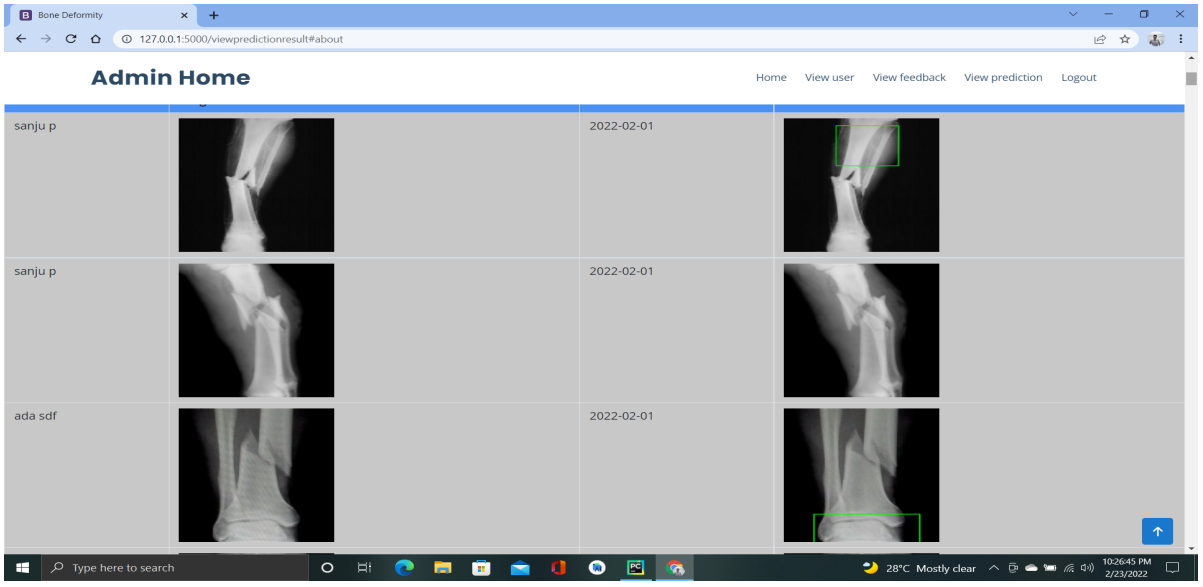

Figure A.6: User Interface 3

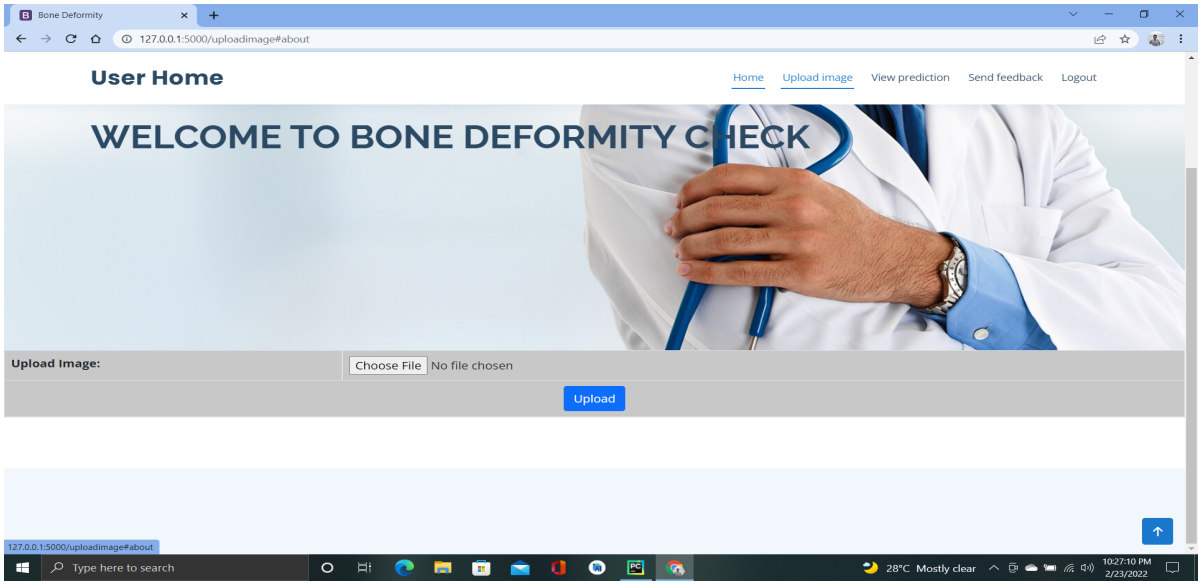

Figure A.7: User Interface 4

User Story

UserStoryID	As a <type of user>	I want to	So that I can
1	Admin	Login	Login successful with correct username and password
2	Admin	View user	View users
3	Admin	View feedback	View users feedback
4	Admin	Data set management	Add and manage images in dataset
5	Admin	View prediction result	View prediction result from user
6	User	Registration	Registration by given user details
7	User	Login	Login by using username and password
8	User	Upload image	Upload image for prediction
9	User	View prediction result	View result of uploaded image
10	User	Feedback	Send feedback

Figure A.8: User Story

Product Backlog

User Story ID	Priority <High/Medium/Low>	Size (Hours)	Sprint <#>	Status <Planned/In progress/Completed>	Release Date	Release Goal
1	Medium	2	1	Completed	08/01/2022	Table design
2	High	3		Completed	08/01/2022	Form design
3	High	5		Completed	08/01/2022	Basic coding
4	High	5	2	Completed	16/01/2022	Creation data set
5	Medium	5		Completed	22/01/2022	Preprocessing
6	High	5	3	Completed	27/01/2022	Training
7	Medium	5		Completed	05/02/2022	Prediction
8	Medium	5	4	Completed	10/02/2022	Testing data
9	High	5		Completed	19/02/2022	Output generation

Figure A.9: Product Backlog

Project Plan

User Story ID	Task Name	Start Date	End Date	Days	Status
1	Sprint 1	26/12/2021	28/12/2021	2	Completed
2		29/12/2021	31/12/2021	3	Completed
3		03/01/2022	08/01/2022	5	Completed
4	Sprint 2	09/01/2022	16/01/2022	8	Completed
5		18/01/2022	22/01/2022	5	Completed
6	Sprint 3	23/01/2022	27/01/2022	5	Completed
7		30/01/2022	05/02/2022	7	Completed
8	Sprint 4	06/02/2022	10/01/2022	5	Completed
9		16/02/2022	19/02/2022	4	Completed

Figure A.10: Project Plan

Sprint Backlog

Backlog Item	Status & completion date	Original estimate in hours	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10	Day11	Day12	Day13	Day14
User story #1,#2,#3		hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table design	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form design	31/12/2021	3	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Coding	08/01/2021	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #4,#5																
Creation dataset	16/01/2022	5	1	1	0	1	0	1	0	1	0	0	0	0	0	0
Preprocessing	22/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #6,#7																
Training	27/01/2022	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Prediction	05/02/2022	5	0	0	0	0	0	0	0	1	0	1	1	1	0	1
User story #8,#9																
Testing data	10/02/2022	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Output generation	19/02/2022	5	0	0	0	0	0	0	0	0	0	2	1	1	1	1
Total		40	4	4	2	4	3	2	0	2	0	5	4	4	3	4

Figure A.11: Sprint Backlog

Sprint Actual

Backlog Item	Status & completion date	Original estimate in hours	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10	Day11	Day12	Day13	Day14
User story #1,#2,#3		hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table design	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form design	31/12/2021	3	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Coding	08/01/2021	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #4,#5																
Creation dataset	16/01/2022	5	1	1	0	1	0	1	0	1	0	0	0	0	0	0
Preprocessing	22/01/2022	5	0	0	0	0	0	0	0	0	0	1	1	1	1	1
User story #6,#7																
Training	27/01/2022	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Prediction	05/02/2022	5	0	0	0	0	0	0	0	1	0	1	1	1	0	1
User story #8,#9																
Testing data	10/02/2022	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Output generation	19/02/2022	5	0	0	0	0	0	0	0	0	0	2	1	1	1	1
Total		40	4	4	2	4	3	2	0	2	0	5	4	4	3	4

Figure A.12: Sprint Actual